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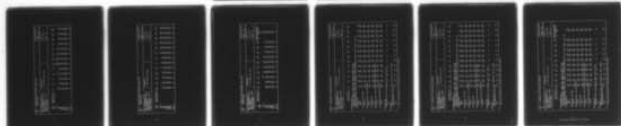
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Volume 114

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6 **USAF BIOENVIRONMENTAL NOISE DATA
HANDBOOK.**

Volume 114.

MB-1 Compressor, Reciprocating, Power Driven.

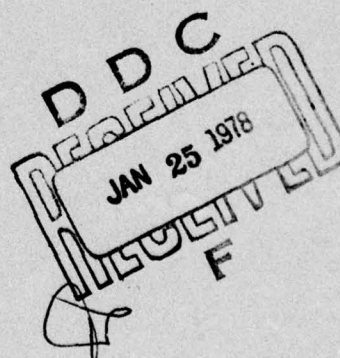
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AEROSPACE MEDICAL DIVISION
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FOR THE COMMANDER


HENNING E. VON GIERKE
Director
Biodynamics and Bionics Division
Aerospace Medical Research Laboratory

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The MB-1 Compressor is an electric motor-driven air compressor designed to furnish a source of high and low pressure for aircraft servicing. This report provides measured data defining the bioacoustic environments produced by this unit operating inside a large aircraft hangar at normal rated/loaded conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived		

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noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol. 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the Handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. ↑

PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 723104, Measurement and Prediction of Noise Environments of Air Force Operations.

The author acknowledges the efforts of Mr. Robert T. England and Mr. Robert G. Powell who conducted the field measurements, and Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report. Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton assisted in the mechanics of data processing, and Mrs. Norma Peachey typed and prepared the graphics.

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NEAR-FIELD NOISE

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INTRODUCTION

The MB-1 Compressor is an electric motor-driven air compressor designed to furnish a source of high and low pressure for aircraft servicing.

This volume provides measured data defining the bioacoustic environments produced by this unit. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the MB-1 compressor.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, ground support equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Volume 2 provides a method and data for adjusting the handbook's far-field noise data, which are for standard meteorological conditions (15C temperature, 70% rel humidity, 0.760 meters Hg barometric pressure) to derive comparable data for other meteorological conditions. *Refer to Volumes 1 and 2* (references 1 and 2) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., inflight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; Autovon 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

2. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 2: Procedure to Evaluate Effects of Non-standard Meteorological Conditions on Far-Field Noise*, AMRL-TR-75-50 (2), AMRL, WPAFB, OH, 1975.

NEAR-FIELD NOISE

MEASUREMENTS

A standard MB-1 Compressor was operated inside, and approximately in the center of a large aircraft hanger (167.6 m long \times 36.6 m wide \times 18.3 m high) on a concrete floor at a normal rated/loaded condition. The hanger walls and ceiling were not acoustically treated. No aircraft were in the vicinity of the unit while being measured. No far-field acoustic data were acquired because of the relatively close proximity of the hanger walls.

Figure 1 identifies 36 noise measurement locations at a height of 1.5 meters above the concrete apron (nominal ear level of ground crew). The 0 degree reference direction passes through the tow bar. These locations are in the acoustic near-field of the source where the sound wave fronts generally do not spherically diverge and the source appears to be spatially distributed (i.e., not a point source). Consequently, these near-field data cannot be extrapolated to longer distances but do properly define the levels at locations close to the unit.

Near-field measurements were also made at ear level at the operator control panel. Table 1 lists the numeric/alphabetic designators used on the data pages in this report to identify the operator measurement location and test conditions. The designator 1/A means operator location 1 and test condition A. Such a descriptor is essential in many handbook volumes that involve multiple combinations of locations/conditions. It is used in this report to maintain format consistency.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced by the MB-1 unit at the 37 specified, near-field locations. This table includes the overall, 1/3 octave band, and octave band levels. From these data one can calculate the variety of measures in Table 3 which are widely used to assess the effects of noise on personnel and their performance.

For data at other intermediate near-field locations (i.e., for radial distances less than 4 meters) you can interpolate between the 36 measured data points.

TABLE 1

MEASUREMENT LOCATION AND TEST CONDITION FOR OPERATOR NOISE MEASUREMENTS

MB-1 Compressor, Reciprocating, Power Driven
Wright Patterson AFB, 8 Nov 1972

Measurement Location

1 Operator Control Panel

Operation

A Air Tank Fill Cycle

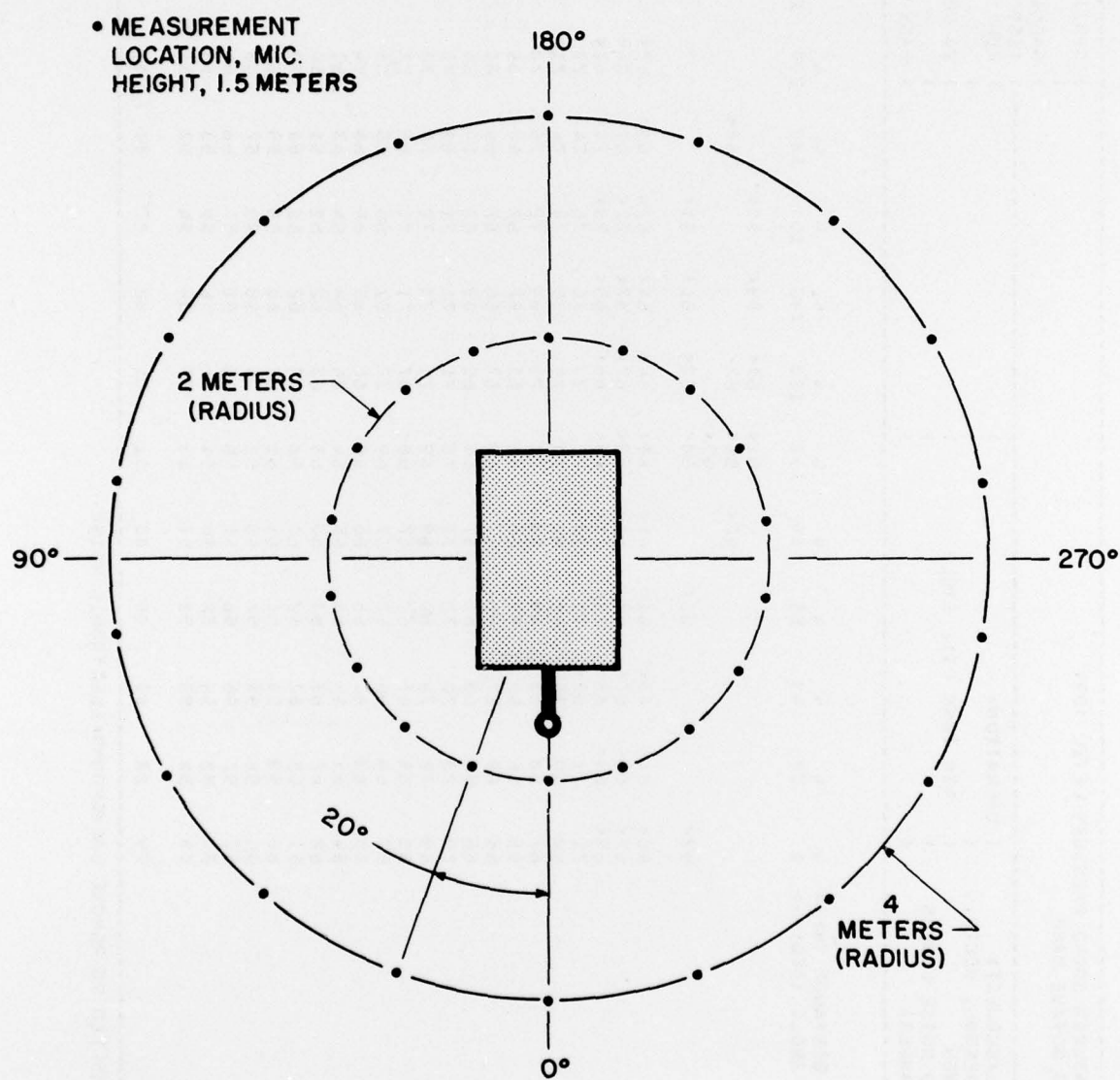


Figure 1. Measurement Locations

TABLE: MEASURED SOUND PRESSURE LEVEL (DB) 1/3 OCTAVE BAND										IDENTIFICATION:									
2																			
NOISE SOURCE/SUBJECT: (OPERATION:)										OMEGA 3.2									
MB-1 COMPRESSOR, RECIP., ()										TEST 71-020-390									
POMER DRIVEN (AIR TANK FILL CYCLE)										RUN 01									
NEAR FIELD NOISE LEVELS ()										24 FEB 75									
(INSIDE HANGER) ()										PAGE F1									
FREQ (HZ)	DISTANCE (M)-->	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
ANGLE (DEG)-->	0																		
25																			
31.5																			
40																			
50																			
63																			
80																			
100																			
125																			
160																			
200																			
250																			
315																			
400																			
500																			
630																			
800																			
1000																			
1250																			
1600																			
2000																			
2500																			
3150																			
4000																			
5000																			
6300																			
8000																			
10000																			
OVERALL																			

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB) 1/3 OCTAVE BAND													IDENTIFICATION:				
2																	
NOISE SOURCE/SUBJECT: (OPERATION:)													OMEGA 3.2				
MB-1 COMPRESSOR, RECIP., ()													TEST 71-020-390				
POWER DRIVEN (AIR TANK FILL CYCLE)													RUN 02				
NEAR FIELD NOISE LEVELS ()													24 FEB 75				
(INSIDE HANGER) ()													PAGE F2				

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB) 1/3 OCTAVE BAND														IDENTIFICATION:	
NOISE SOURCE/SUBJECT: (OPERATION:)														OMEGA 3.2	
MB-1 COMPRESSOR, RECIP., ()														TEST 71-020-390	
POWER DRIVEN (AIR TANK FILL CYCLE)														RUN 03	
NEAR FIELD NOISE LEVELS ()														24 FEB 75	
(INSIDE HANGER)														PAGE F3	
FREQ (HZ)	DISTANCE (M)--> ANGLE (DEG)-->	160	180	200	220	240	260	280	300	320	340	OPERATOR LOCATION 1/A			
25				59<								64<			
31.5		64<	67<	69<			61<	65<	64<	64<	64<	71<			
40					63<	62<	61<	60<				61<			
50															
63															
80															
100		67<	67<	66<	65<	66<	66<	66<	65<	63<	62<	66<			
125		70<	70<	70<	69<	70<	59<	69<	68<	67<	65<	68<			
160		75	76	77	71<	70<	70<	70<	70<	68<	69<	70<			
200		76	80	79	71	70	71	69<	71	70	70	72			
250		74	76	77	71	68	68	69	68	69	69	77			
315		77	75	77	72	70	68	71	68	67	67	76			
400		73	74	76	71	71	71	71	69	68	68	73			
500		72	71	74	71	70	71	71	70	70	70	72			
630		71	70	71	68	67	68	69	69	70	70	74			
800		74	71	71	70	74	69	70	71	70	70	73			
1000		75	76	73	73	74	73	72	73	72	70	72			
1250		73	73	73	73	71	72	71	73	73	70	71			
1600		70	69	71	69	71	72	71	70	73	70	69			
2000		68	67	67	68	69	68	70	69	69	68	67			
2500		66	67	66	67	67	68	68	68	68	68	66			
3150		64	65	64	65	66	66	66	66	66	65	64			
4000		65	64	64	65	67	66	66	67	66	63	64			
5000		63	62	63	62	64	64	65	65	65	63	61			
6300		61	60	60	60	62	62	63	63	62	61	60			
8000		60	59	60	59	61	62	62	62	61	60	58			
10000		57	57	57	57	60	56	61	60	59	59	56			
OVERALL		85	86	86	83	82	82	82	82	82	81	84			
< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.															

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TABLE: MEASURED SOUND PRESSURE LEVEL (DB)													
OCTAVE BAND													
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IDENTIFICATION:													
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TABLE: MEASURES OF HUMAN NOISE EXPOSURE														IDENTIFICATION:	
3															
NOISE SOURCE/SUBJECT: (OPERATION:)															
MB-1 COMPRESSOR, RECIP., ()														OMEGA 3.2	
POWER DRIVEN ()														TEST 71-020-390	
NEAR FIELD NOISE LEVELS ()														RUN 01	
(INSIDE HANGER) ()														24 FEB 75	
														PAGE H1	
DISTANCE (M)--> 4 4 4 4 4 4 4 4 4 4 4 4 4 4															
ANGLE (DEG)--> 0 20 40 60 80 100 120 140 160 180 200 220 240															
HAZARD/PROTECTION															
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR															
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR															
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)															
NO PROTECTION															
OASLC															
OASLA															
T															
MINIMUM OPL EAR MUFFS															
OASLA*															
T															
AMERICAN OPTICAL 1700 EAR MUFFS															
OASLA*															
T															
V-51R EAR PLUGS															
OASLA*															
T															
AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS															
OASLA*															
T															
H-133 GROUND COMMUNICATION UNIT															
OASLA*															
T															
COMMUNICATION															
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)															
PSIL															
ANNNOYANCE															
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)															
TONE CORRECTION (C IN DB)															
PNLT															
C															
* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.															

